



DEPARTMENT OF THE NAVY

MARE ISLAND NAVAL SHIPYARD  
695 WALNUT AVE SUITE 5100  
MARE ISLAND, CA 94592-5100

IN REPLY REFER TO:

9900  
Ser 105.2/156  
JUL 22 1994

From: Commander, Mare Island Naval Shipyard  
To: Commander, Western Division, Naval Facilities Engineering Command  
Subj: INVESTIGATION OF RADIUM RADIOACTIVITY DISCOVERED DURING NAVAL NUCLEAR  
PROPULSION PROGRAM RADIOLOGICAL RELEASE SURVEYS OF EX-HUNTERS POINT  
NAVAL SHIPYARD DRY DOCK NUMBER 4

Ref: (a) NAVSHIPYD MARE ltr 9900 Ser 105.2/6 of 11 Jan 94  
(b) NAVSEA ltr 08R Ser 08R/94-11137 of 9 Feb 94  
(c) NAVSHIPYD MARE ltr 9900 Ser 105.2/85 of 22 Jul 94

Encl: (1) Drawing of Southeast Section of Dry Dock #4  
(2) Photographs of Dry Dock #4  
(3) Diagram of Solid Sample Locations

1. Mare Island Naval Shipyard (NAVSHIPYD MARE) has performed radiological surveys of ex-Hunters Point Naval Shipyard Dry Dock #4 to release the dry dock from Naval Nuclear Propulsion Program (NNPP) radiological controls. Ex-Hunters Point Naval Shipyard was purchased by the Navy in 1939 and was closed in 1974. During this time, no nuclear powered ships were dry docked at the ex-Hunters Point Naval Shipyard facility. Beginning in 1985, the Navy used ex-Hunters Point Naval Shipyard to support dry-docking nuclear powered surface combat ships. In April 1985, baseline radiological surveys were performed. Surveys were also performed after each of five dry-dockings confirming the radiological condition of the dry dock. The results of the surveys are provided in reference (a). In reference (b), Naval Sea Systems Command approved the release of Dry Dock #4 at ex-Hunters Point Naval Shipyard from NNPP radiological controls, pending submission of information on radium radioactivity found in a trench, hereafter referred to as a channel, in the bottom of Dry Dock #4 to the Naval Facilities Engineering Command so an additional evaluation could be made.

2. The area of concern in Dry Dock #4 was Grid D-1, as shown in enclosure (1). The location of radium radioactivity was approximately 34 feet from the caisson well and 8 feet from the east dry dock wall. This area corresponds to a drainage channel molded into the dry dock floor (see enclosure (2) photographs A and B). This drainage channel takes outflow from a drainage pipe 5 inches in diameter. The drainage pipe goes up the dry dock wall to a mid level tier approximately 28 feet above the dry dock floor (see enclosure (2) photograph C), continues across the tier floor and takes outflow from a drainage channel which is against the dry dock wall. This drainage channel collects water from behind the dry dock wall.

3. Surveys of the channel were taken using an IM-253 portable gamma scintillation meter with a SPA-3 sodium iodide (NaI) detector and a portable Series 10 Canberra multi-channel analyzer with a pure germanium detector.

Subj: INVESTIGATION OF RADIUM RADIOACTIVITY DISCOVERED DURING NAVAL NUCLEAR  
PROPULSION PROGRAM RADIOLOGICAL RELEASE SURVEYS OF EX-HUNTERS POINT  
NAVAL SHIPYARD DRY DOCK NUMBER 4

a. Survey scans using the IM-253 were performed in the HV2-GROSS mode. The IM-253 survey meter responds to gamma energies from 0.1 to approximately 8.0 MEV in the HV-2 GROSS mode. Survey results showed that only one small spot in the drainage channel exhibited elevated radiation levels.

b. Initial Series 10 Canberra multi-channel analysis identified the isotopes as radium-226, lead-214, bismuth-214, and potassium-40. Radium, lead, and bismuth are daughter products of the naturally occurring Uranium-238 decay chain. Potassium is a commonly found naturally occurring radioactive isotope.


4. While attempting to obtain a solid material sample of the debris from the bottom of the channel, in an effort to better characterize the radioactivity, a small metal button was uncovered. The metal button measured approximately 3/4 inch in diameter and 1/4 inch high and had a clear epoxy lens covering. The clear epoxy lens covering was noted to be cracked in several locations. The metal button exhibited radiation levels of 4 millirem/per hour as measured with an AN/PDR-27. The AN/PDR-27 is a general purpose low range beta-gamma survey meter utilizing low sensitivity and high sensitivity Geiger-Muller (G-M) detectors. The metal button was then isotopically analyzed with the analysis indicating cadmium-109, radium-226, lead-214, and bismuth-214. The concentrations of each isotope indicate the metal button is a radioactive source of some unknown origin. NAVSHIPYD MARE does not use this type of radioactive source in support of NNPP. No markings were found on the metal button, hereafter referred to as a G-RAM source, identifying it as radioactive material or as a radioactive source.

a. A total of three 500 gram solid material samples were taken from the bottom of the channel after removal of the G-RAM source; one upstream, one from where the G-RAM source was removed and one downstream (see enclosure (3) for a map of sample locations). The samples were analyzed for isotopic identification using a multichannel analyzer with a minimum detectable activity (MDA) of  $1 \times 10^{-6}$  microcuries ( $\mu\text{Ci}$ )/gram. Results of the analysis showed the presence of thorium-234, radium-226, lead-214, bismuth-214, and potassium-40 in all three samples. Thorium, radium, lead, and bismuth are daughter products in the naturally occurring uranium decay chain. A gross gamma analysis using a multichannel analyzer with a MDA of  $1 \times 10^{-6}$   $\mu\text{Ci}$ /gram was also performed on the samples to quantify the radioactivity. Results of the gross gamma analysis indicated the highest concentrations were near the outflow of the drainage pipe and decreased in concentration as the water flowed down the channel. See enclosure (3) for sample results. Since no cadmium-109 specific to the G-RAM source was found in the solid material samples it is concluded that the radioactivity found in the samples is from the decay of naturally occurring uranium, not from the G-RAM source. The presence of thorium-234, which is specific to the uranium decay chain and which was found in the solid material samples also supports this conclusion.

Subj: INVESTIGATION OF RADIUM RADIOACTIVITY DISCOVERED DURING NAVAL NUCLEAR  
PROPULSION PROGRAM RADIOLOGICAL RELEASE SURVEYS OF EX-HUNTERS POINT  
NAVAL SHIPYARD DRY DOCK NUMBER 4

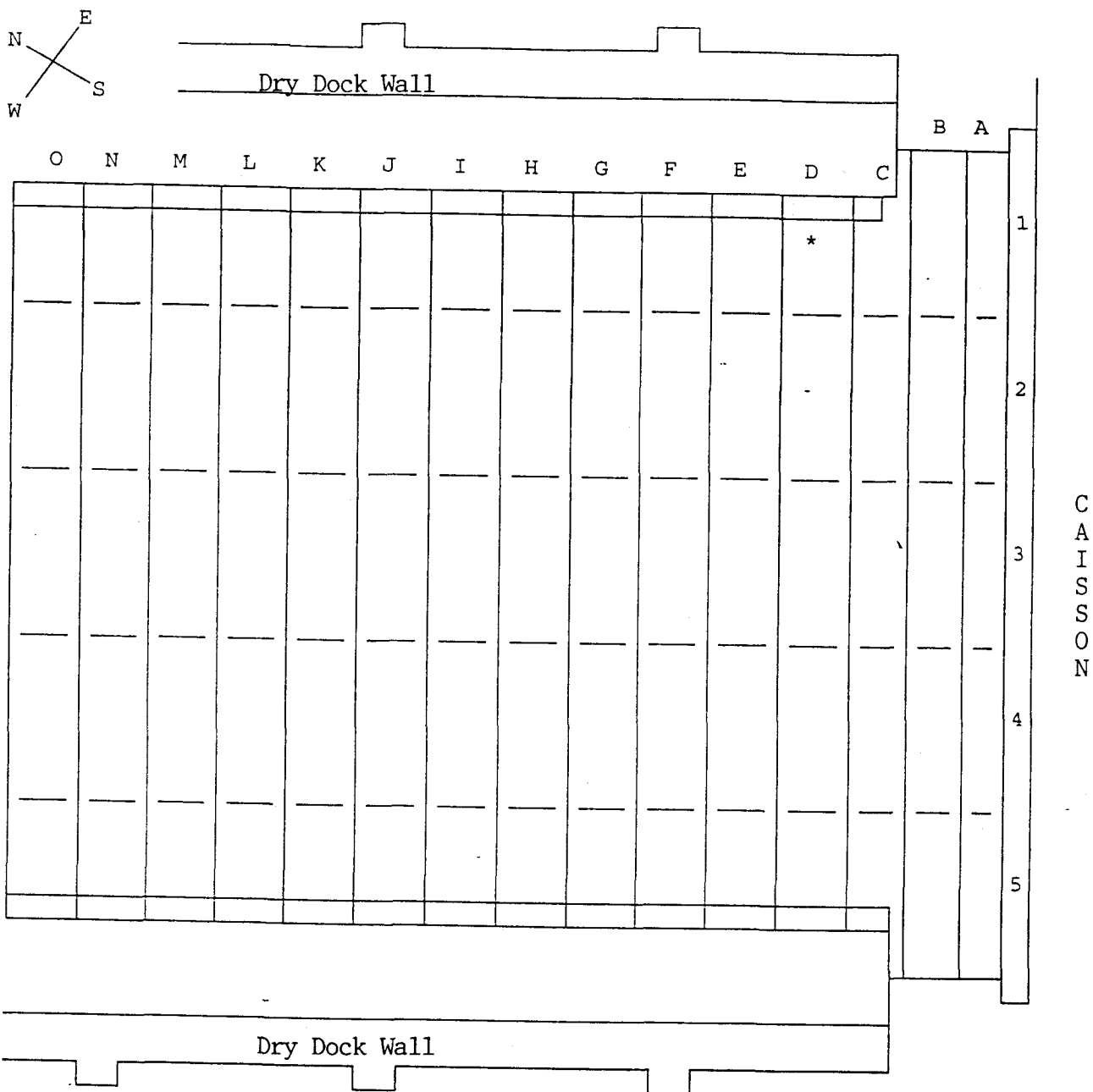
b. After removal of the G-RAM source, the area was again surveyed using an IM-253 survey meter. The results showed levels were commensurate with those found in other parts of the dry dock during the reference (a) radiological release surveys. No elevated radioactivity levels remain.

5. No NNPP radioactive materials were identified during the final radiological surveys of ex-Hunters Point Naval Shipyard Dry Dock #4. Ex-Hunters Point Naval Shipyard Dry Dock #4 is released from NNPP radiological controls per reference (c). The above information on the naturally occurring radioactivity and G-RAM source is forwarded for your information and action as appropriate.

  
R. D. O'BRIEN  
By direction

Copy to:  
NAVSEA (08R)  
NRRO (Mare)

# SOUTHEAST SECTION OF DRY DOCK NO. 4

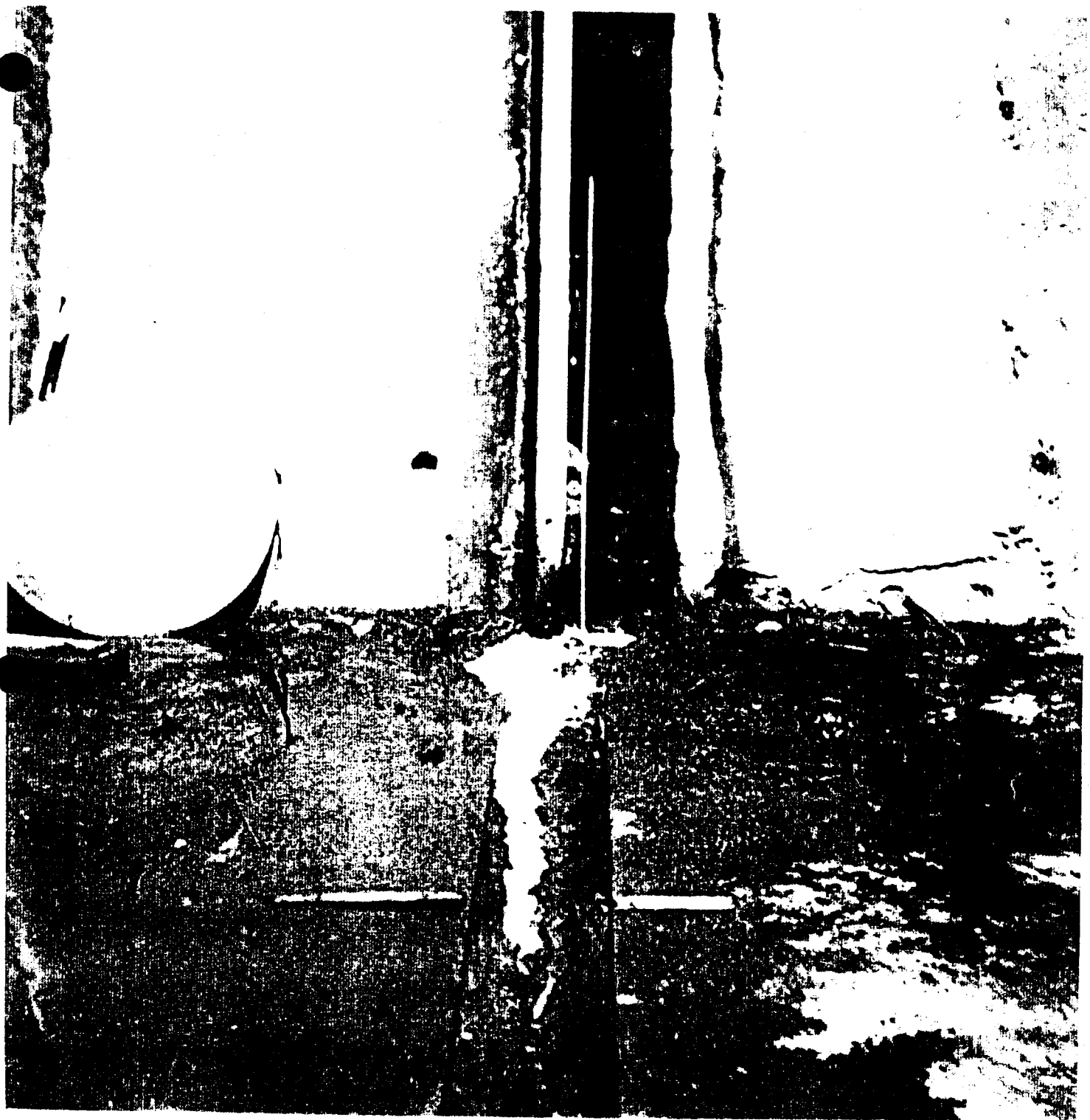


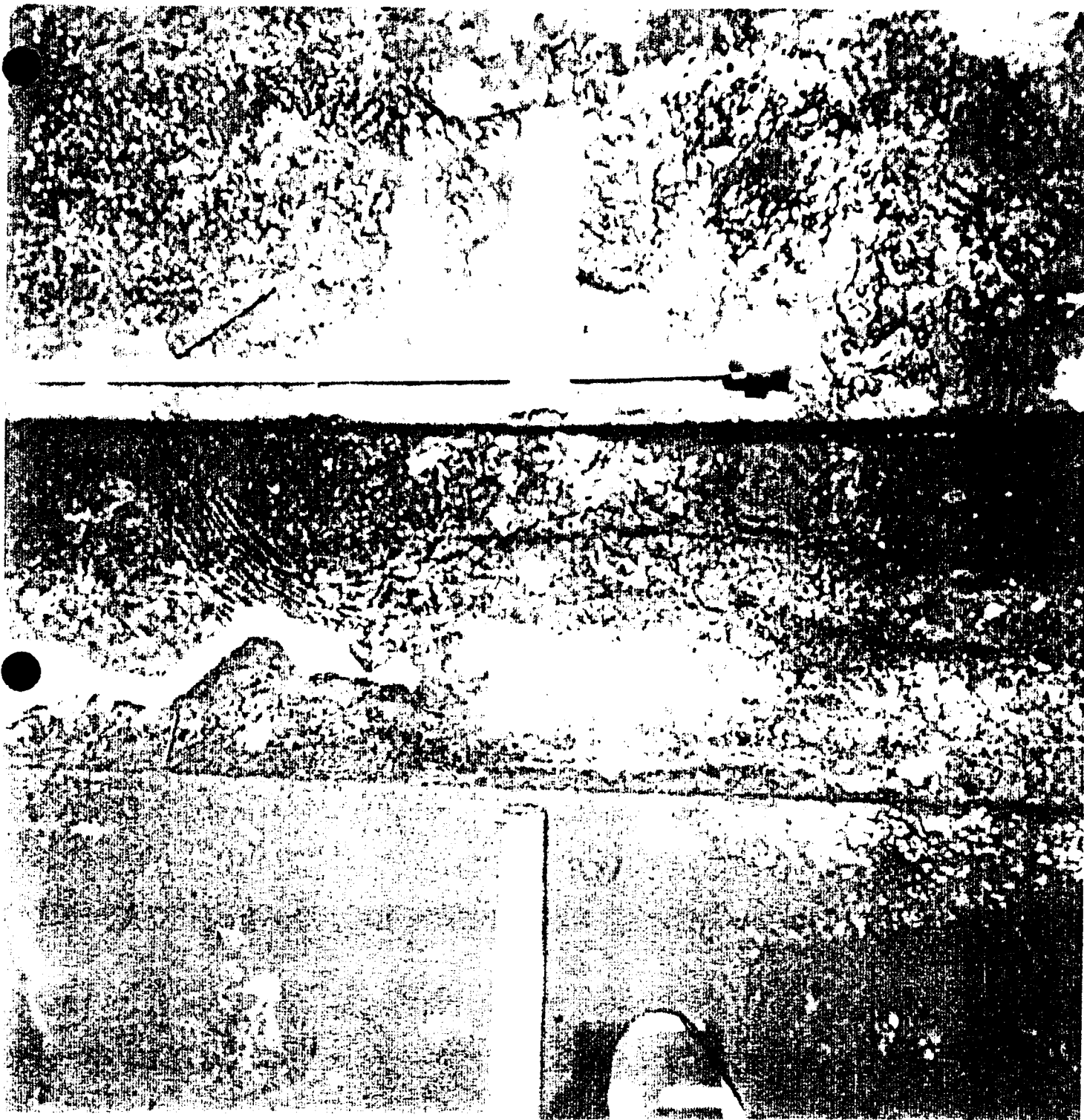
(NOT TO SCALE)

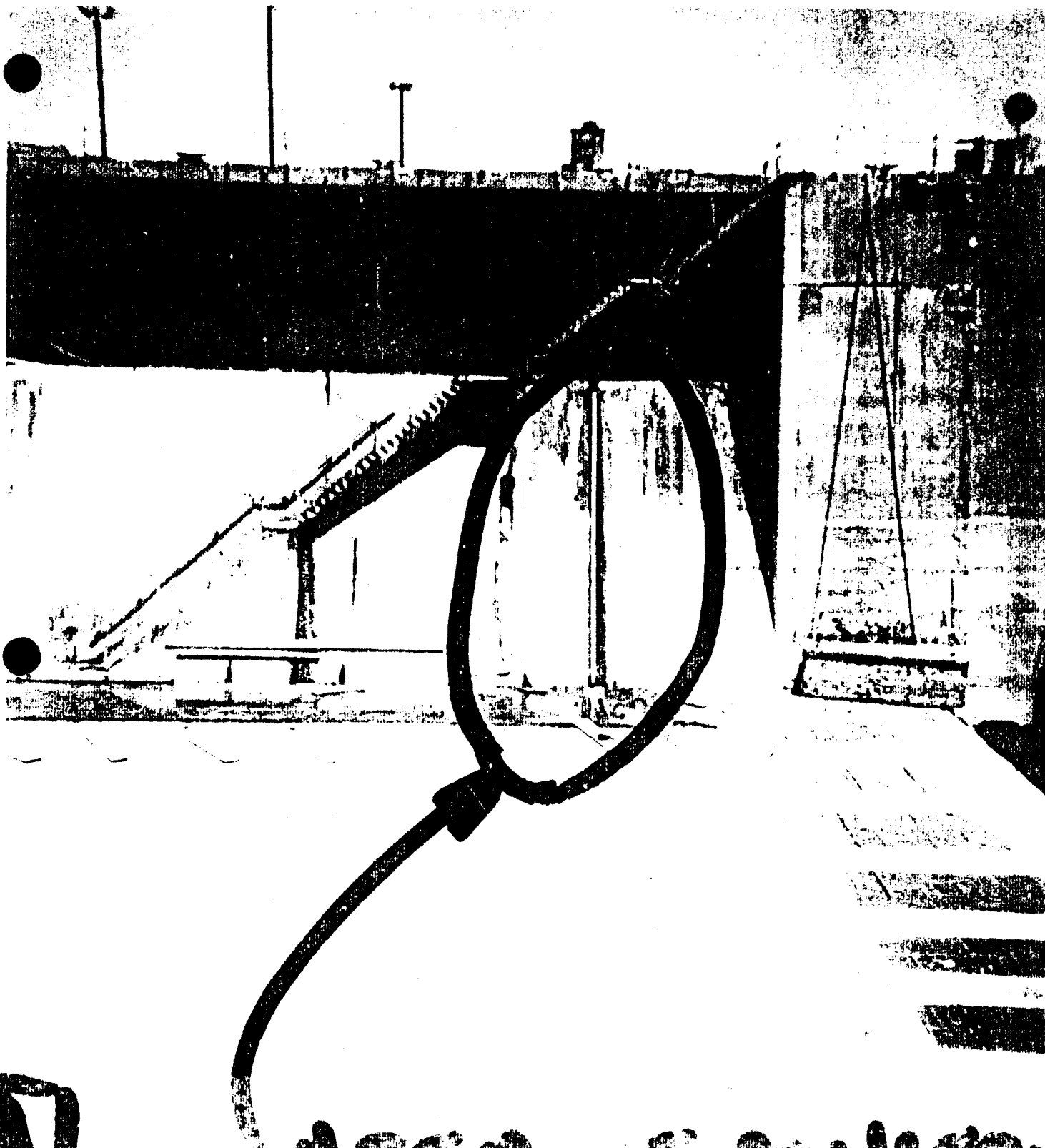
\* Denotes area where IM-253 survey meter readings were greater than twice natural background radiation levels obtained during the initial survey procedure.

NOTE (1) A, B, C, 1, 2, 3 are grid designators.

Enclosure (1)



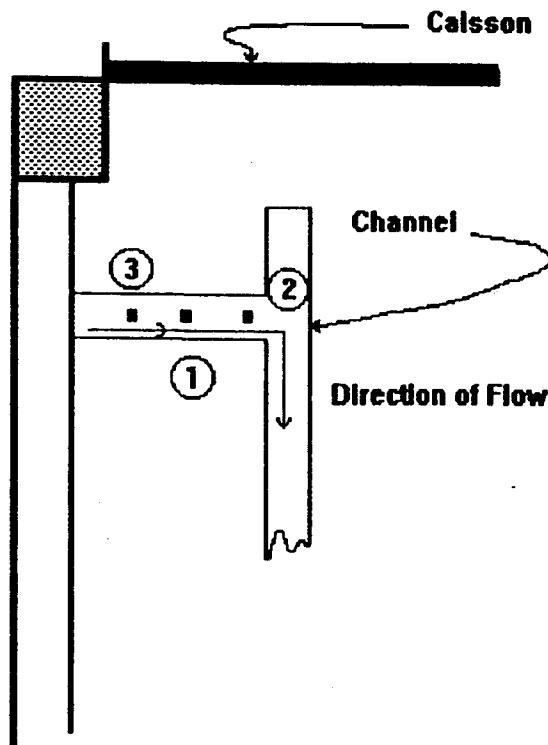




AREA OF COLLAPSE

HP DD #4

# DIAGRAM OF SOLID SAMPLE LOCATIONS



1

Sample of area where metal button was

Sample results:  $3.27 \times 10^{-5}$  uCi/gm of total activity  
 $7.39 \times 10^{-6}$  uCi/gm of Ra-226 activity

2

Sample downstream of metal button

Sample results:  $1.70 \times 10^{-5}$  uCi/gm of total activity  
 $3.33 \times 10^{-6}$  uCi/gm of Ra-226 activity

3

Sample upstream of metal button

Sample results:  $3.60 \times 10^{-5}$  uCi/gm of total activity  
 $9.72 \times 10^{-6}$  uCi/gm of Ra-226 activity

Enclosure (3)